

CLAIMS

1. Method for joining the edges of a tubular knitted article, such as a stocking, upon the completion of the latter on a circular machine, characterized in that it comprises the following operating steps:

a) knitting the article (6) by starting on one edge or hem to end up on the toe side by leaving the latter open;

b) moving the machine's removable parts (5) away from the knitting head (100) of the same circular machine so as to clear the top of the cylinder (1) of needles (2);

c) removing the stitches of the last knitted rank and retaining them onto suitable removal means (25, 26) supported by a movable carrier (300) between a knitting station defined by the knitting head (100) of said machine and a closing and/or hooking-up station (400) located at a preset distance from the other station;

d) moving said removal means (25, 26) together with the article (6) away from the machine's knitting head (100) to move the same article up to said closing and/or hooking-up station (400);

e) turning the article (6) inside-out while it is retained by said removal means (25, 26);

f) moving the stitches of a first semi-rank, corresponding in practice to half the stitches retained by said removal means (25, 26), so that, by an overturning through approximately 180° about a diametral axis of the circumference defined by the removal means (25, 26), each of the moved stitches will result juxtaposed and coaxial to the corresponding stitch of the other semi-rank's stitches;

g) moving the stitches of the pairs close to each other;

h) carrying out the hook-up of said pairs of stitches so as to obtain the definitive union of the edges of the article (6);

i) unloading the article from the means on which the hook-up operation has been performed.

2. Method according to claim 1, characterized in that the said step d) of moving the article away from the knitting head is performed after the step e) of inside-out-turning the article.
- 5 3. Method according to claim 1, characterized in that the said step d) of moving the article away from the knitting head is performed after the step f) of transferring the stitches.
- 10 4. Method according to claim 1, characterized in that the said step d) of moving the article away from the knitting head is performed after the step g) of approaching the stitches.
- 15 5. Method according to claim 1, characterized in that the step g) of approaching the stitches is carried out on the means (25) that support the stitches of a second semi-rank, that is, a semi-rank of stitches which the overturned stitches are brought near to.
- 20 6. Method according to claim 1, characterized in that the step g) of approaching the stitches is carried out on the means (25) that support the stitches of a first semi-rank, that is, a semi-rank whose stitches are overturned.
7. Method according to claim 1, characterized in that the said step h) is carried out on the same removal means (25, 26).
- 25 8. Method according to the preceding claims, characterized in that the said step h) is carried out on means (40) which support the pairs of stitches and do not belong to the removal means (25, 26) and upon the transfer of the pairs of stitches onto said means (40).
- 30 9. Method according to the preceding claims, characterized in that the article is moved back to its right-side out condition after unloading it from the support means for the hook-up.
- 35 10. Method according to claims 1 and 9, characterized in that the article is moved back to its right-side out condition by

the same means which operate the said inside-out turning step e).

11. Method according to the preceding claims, characterized in that separate means (26, 25) of said movable carrier are used for the removal respectively of the stitches of the first and second semi-ranks.

12. Method according to claim 11, characterized in that the means (26) for the removal of the stitches from the first semi-rank are moved relative to the means (25) for the removal of the stitches from the second semi-rank.

13. Method according to claim 11, characterized in that means (26) are used for the removal of stitches from the first semi-rank, said means being disposed along an arc of circumference having a radius different from that of a corresponding arc of circumference on which the means (25) for the removal of the second semi-rank are disposed.

14. Method according to claim 11, characterized in that means (26) are used for the removal of stitches from the first semi-rank which have different dimensions from those of the means (25) for the removal of the second semi-rank.

15. Apparatus for joining the edges of a tubular knitted article, such as a stocking, upon the completion of the latter on a circular machine, characterized in that it comprises a movable carrier (300) able to be associated with a knitting head (100) of a circular machine and movable from said knitting head (100) and a station of closing and/or hooking-up (400), said carrier (300) supporting means (25, 26) for the removal of stitches of the last knitted rank, comprising means (26) for the removal of one semi-rank, that is, of half the stitches of said last knitted rank, and means (25) for the removal of the other semi-rank, and in that the same movable carrier (300) is provided with driving means (22, 23) and transfer means (28) able to move the stitches of one semi-rank onto the means (26) which remove the other semi-rank.

16. Apparatus according to claim 15, characterized in that the said movable carrier (300) comprises a support body (11) on which hooks (14) are provided intended to move the stitches onto the needles (2) of the knitting head (100) during the removal thereof.

17. Apparatus according to claim 16, characterized in that the said hooks (14) are inserted into corresponding slots (130) disposed vertically and exhibiting a crown (13) for supporting the hooks which is disposed externally and coaxially to said support body (11).

18. Apparatus according to claim 17, characterized in that it is provided with a hollow cylindrical element or cam element (12) interposed between the said body (11) and said crown (13).

19. Apparatus according to one of claims 16-18, characterized in that the said hooks (14) have substantially an "L" shape, the short leg of which is disposed below, and the upper end (140) of which is inserted into an annular cavity (131) of rectangular cross-section, externally presented by said crown (13), the said hooks exhibiting, in correspondence of said upper end (140), a groove (141) on the outer side and a triangular portion defining a step (142) on the inner side, said step being connected with the apex (144) of the upper end (140) via an oblique portion (143); an elastic ring being received in said grooves (141) and retaining said ends (140) inside said cavity (131) thereby causing, when in open configuration, the stems of the hooks (14) to be inclined outwardly.

20. Apparatus according to claim 17, characterized in that externally to said crown (13) provision is made for a ring (15) intended to move the said hooks (14), and being fitted on the crown (13) for sliding vertically relative thereto, the same ring (15) having one or more spiral slots (150) which define corresponding cams able to drive vertically said ring (15) upon a rotary movement of corresponding pivots

inserted into the slots (150).

21. Apparatus according to claim 18, characterized in that the said cam element (12) exhibits one or more slots (120) wherein corresponding pivots (132) are inserted for
5 connecting the same cam element (12) with the crown (13).

22. Apparatus according to claim 15, characterized in that the said removal means comprise a first semi-crown (21) which supports the removal members (26) of the first semi-rank and a second crown (20) which supports the members (25) for the
10 removal of the second semi-rank, said members (26) for the removal of the first semi-rank being disposed on a semicircular sector (22) hinged on the body (10) of the movable carrier in correspondence of two hinges (23) disposed diametrically opposite.

23. Apparatus according to claim 15 or claim 22, characterized in that the said means (26) for the removal of the first semi-rank are made up of a straight and flat body which in its distal end (251) is tapered and provided, on the
15 taper side, with a notch (252), and on the opposite side has a stem (250) by which it is retained firmly by relevant support means (21).

24. Apparatus according to claim 15 or claim 22, characterized in that the said means (25) for the removal of the second semi-rank are made up of a removal member (25) with a straight and flat body which in its distal end (251)
20 is tapered and, on the taper side, is provided with a notch (252), and on the opposite side has a stem (250) with a profile (254) which defines a cam.

25. Apparatus according to claim 24, characterized in that it comprises an elastic means of reaction (19) and a semi-ring (24), disposed and acting, with opposite directions, on said
25 removal member (25).

26. Apparatus according to claim 25, characterized in that said elastic means (19) has a reaction directed centripetally and said semi-ring (24) interacts with the profile (254) of
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said removal member (25)

27. Apparatus according to claim 22, characterized in that the said members (26) for the removal of the first semi-rank are disposed on said semi-crown (21) along an arc of
5 circumference having a radius different from that of a corresponding arc of circumference on which the means (25) for the removal of the second semi-rank are disposed.

28. Apparatus according to claim 22, characterized in that the said members (26) for the removal of the first semi-rank
10 have dimension different from that of the members (25) for the removal of the second semi-rank.

29. Apparatus according to claim 22, characterized in that it comprises a stitch-pushing semi-crown (28) able to push the stitches of the article (6) along the first semi-rank-
15 removing members (26) and move them up onto the second semi-rank-removing members (25).

30. Apparatus according to claim 22, characterized in that it comprises a second stitch-pushing semi-crown (27) able to push the pairs of stitches of article (6), which are engaged
20 on the second semi-rank-removing members (25), onto corresponding means (40) provided in the closing and hooking-up station (400).

31. Apparatus according to claim 29 and/or 30, characterized in that the said semi-crowns (27, 28) are substantially comb-
25 like shaped, with a series of slots (270, 280) angularly spaced apart by extents corresponding to the relevant angular displacements existing between respective first and second semi-rank-removing members (26, 25).

32. Apparatus according to claim 15, characterized in that it comprises a device for turning the article inside-out.
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33. Apparatus according to claim 32, characterized in that the inside-out turning device comprises a inside-out-turning tube (30) movable between two positions for the inside-out-
turning operation, and within which the article is introduced
35 before being turned inside-out.

34. Apparatus according to claim 33, characterized in that it comprises means able to generate a pneumatic flow inside said inside-out-turning tube (30)..

5 35. Apparatus according to claim 32, characterized in that it comprises an inside-out-turning tube (30) made up of two coaxial elements (35, 36) fitted one onto the other and whose front ends (350, 360), that is, those facing the article (6) prior to the inside-out-turning operation, are so shaped as to define, alternately, a closed ring or an open semi-ring by
10 a rotation of the two elements (35, 36) relative to each other and about the common longitudinal axis.

36. Apparatus according to claim 35, characterized in that the outer tubular element (35) exhibits, in correspondence of said end (350), a semi-ring (351) defined by a cylindrical
15 surface extending through 180° approximately.

37. Apparatus according to claim 35, characterized in that the inner tubular element (36) exhibits, in correspondence of its end (360), a semi-cylindrical shape, that is, a wall developing over 180° approximately on one side only with
20 respect to the longitudinal axis.